ARMORED FORCE MEDICAL RESEARCH LABORATORY
Fort Knox, Kentucky

February 20, 1943

Project No. 6 (6-1, 6-6)
File No. 413-74

AD658566

VISUAL REQUIREMENTS FOR SPOTTING

1. PROJECT: No. 6, Vision in Tanks. Sub-projects No. 6-1, Visual Requirements for Spotting, and No. 6-6, Investigation of Periscopic Binocular Spotters.

a. Authority: Letter Commanding General, Headquarters Armored Force, Fort Knox, Kentucky, File 400.112/6 GNOHD, dated September 21, 1942.

b. Purpose: To determine the requirements for spotting and to recommend means for meeting them.

2. DISCUSSION:

a. The tank commander's visual requirements have been studied in relation to: Needs for enemy detection, rangefinding, spotting of fire, and correction of range.

b. The deficiencies of present equipment and practices have been determined on the basis of effectiveness of performance, reports of casualties and from knowledge of technical properties of the visual devices now provided.

c. Design and production of suitable equipment have been investigated.

d. Pertinent information and detailed discussion are given in the appendix.

3. CONCLUSIONS:

a. The use of binoculars leads to unnecessary casualties in tank commanders.

b. The binoculars now issued are unsuited to adverse light conditions.

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4. RECOMMENDATIONS:

a. That three (3) pairs of periscopic binoculars of the general characteristics and specifications given in the inclosure and under Appendix I, B 4 be developed, the instruments when completed to be shipped to the Armored Force, Fort Knox, Kentucky, for test.

Reported by:
Major F. S. Brackett, Sn C.

APPROVED Willard Machle
WILLARD MACHLE
Lieut. Col., Medical Corps
Commanding.

2 Incls:
#1 - Appendix I
#2 - Drawings - Periscopic Binoculars

APPENDIX I

A. INTRODUCTION

1. The tank commander must identify targets, estimate range, and determine the error of fire by spotting tracer or HE explosion. In order to use the binoculars which are issued for this purpose he must expose his head to enemy fire with the result that the percentage of casualties in commanders is disproportionately high. Errors of fire are chiefly in elevation due to lack of range information, and the number of shots necessary to find the target is unduly large. Fire under adverse light conditions will be handicapped by limitations or deficiencies in the optical design and manufacture of the present binoculars.

B. IDENTIFICATION OF TARGET AND SPOTTING

1. Optical Properties.

It is generally agreed that the optical properties of good night binoculars are well suited to the identification of targets and the spotting of fire. These properties are:

a. Power 6 - 8x
b. Exit pupil 6.5 to 7.5 mm
c. True field 8° to 10°
d. Maximum freedom from veiling haze and flare image) Inner surfaces should be bloomed or half-wave coated.
e. Maximum light transmission

2. Form of the Instrument.

The failure to supply a periscopic form of instrument is the chief cause of the high percentage of commander casualties. The same optical properties can be secured in this form as are found in good binoculars.

3. Present Equipment.

The binoculars now employed are of an intermediate type (6 x 30)-- better than an ordinary "day glass" but not so good as a "night glass" for low light intensity and low contrast, the exit pupil being 5 mm as against 7 mm (as in the 7 x 50 night glass).

The laboratory is not yet equipped with the special instruments for a complete test of binoculars. One (1) pair of binoculars, examined, exhibited adequate definition. They appeared to be of good mechanical design.

4. Proposed Spotter.

a. A periscopic binocular is shown in the preliminary layout by the accompanying drawing (Inclosure #2).

b. Specifications of this instrument are:

Power	7x
True Field	10°
Exit Pupil	7 mm
Eye Relief	20 mm

Surfaces to be bloomed
(Curvatures shown are purely conventional)
Diaphragms to be so disposed as to eliminate wall reflection.

c. Optics of this character have been designed by Dr. Brian O'Brien's Group of Sec. D-3, N.D.R.C.

d. Instrument is designed to be held in the hand (or mounted in holder*). The seven-inch periscopic offset shown is sufficient to keep the head below the armor. If more offset is desired it can be obtained with a small loss of peripheral brightness of field.

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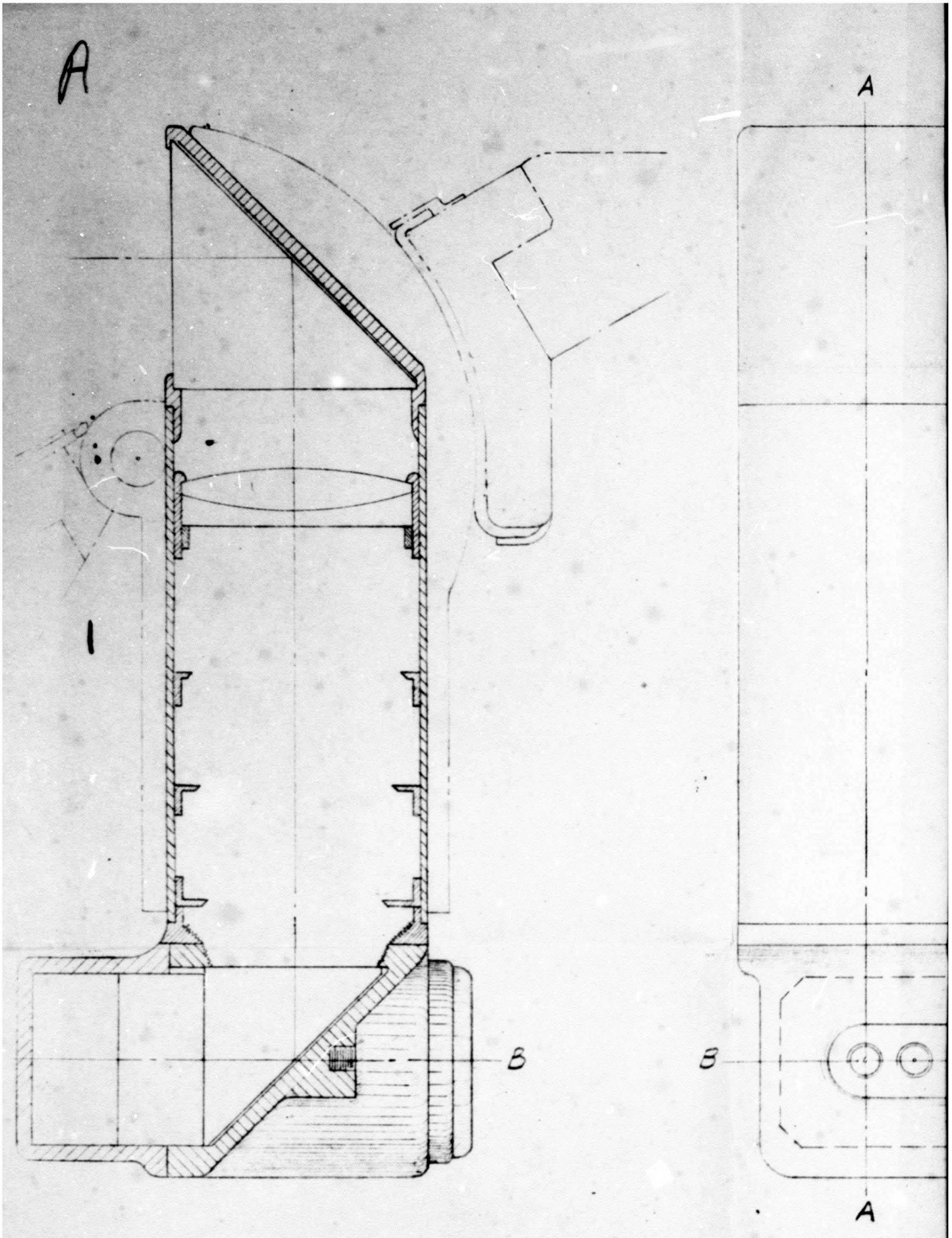
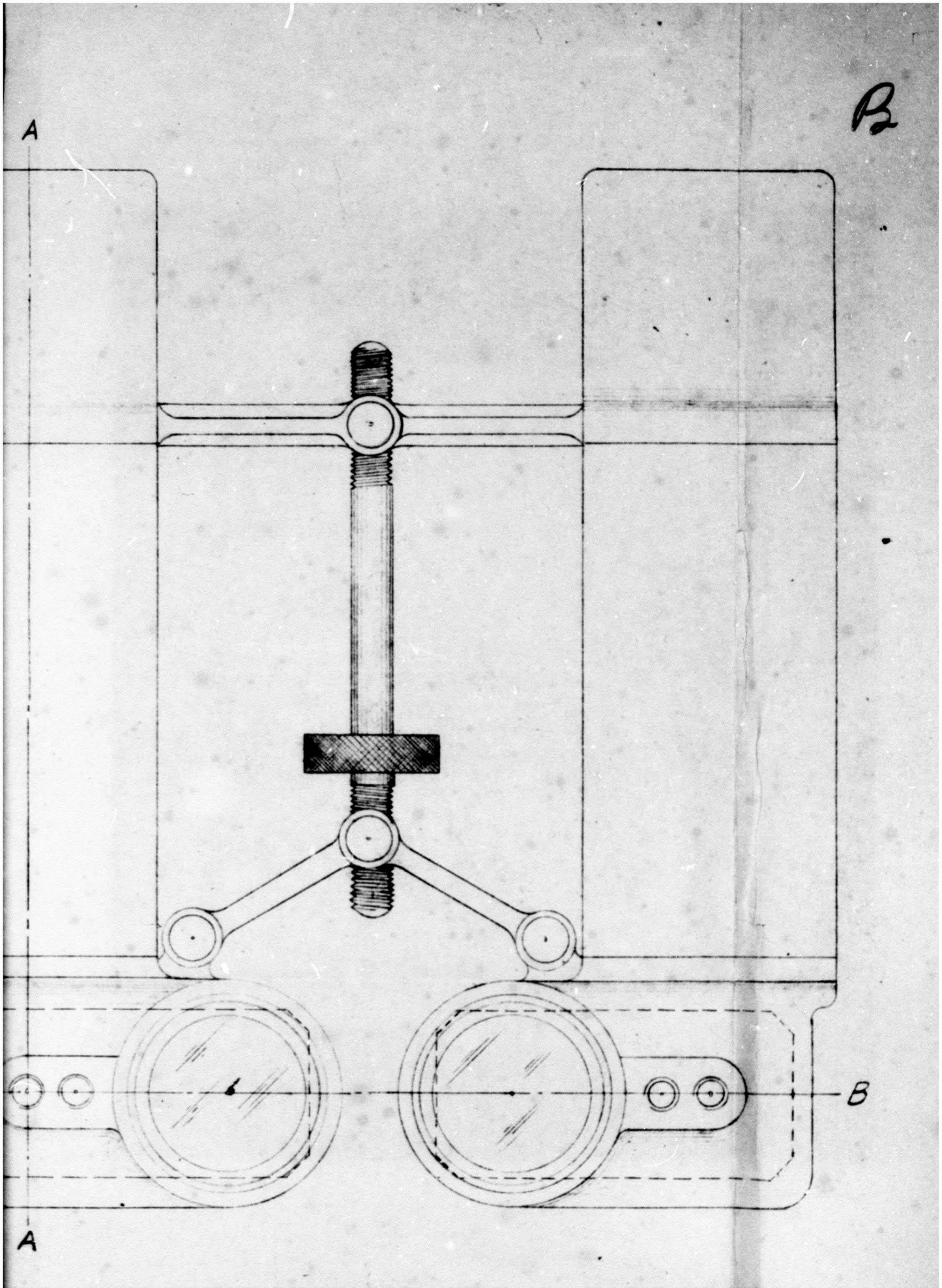
* NOTE: The holder for an instrument of this degree of offset must be mounted in sloping or crowned armor as suggested by dotted lines in Section A-A. Such a holder might be mounted on the rotating ring of the commander's hatch using a single hatch cover. (The opening required is $2\frac{1}{4}$" x $8\frac{1}{2}$").



SECTION A-A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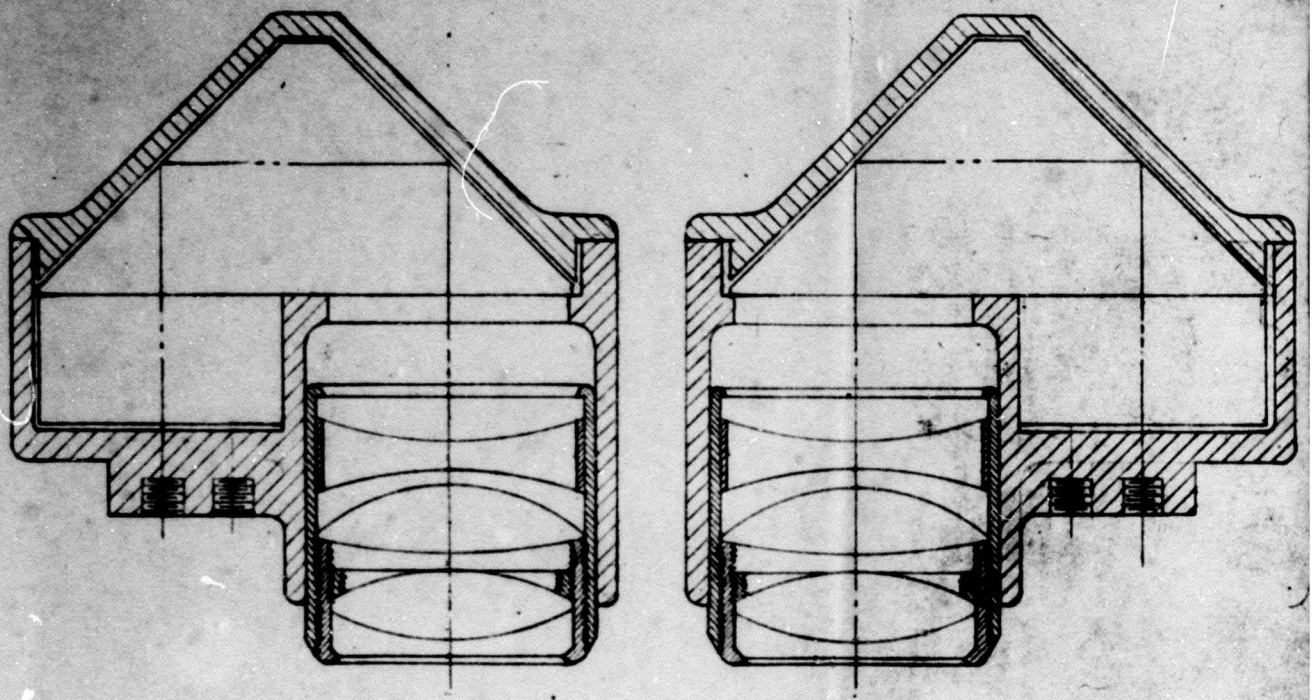
PERISCOPIC BINOCULARS

POWER x 7
TRUE FIELD 10°
EXIT PUPIL 7MM
EYE RELIEF 20MM



SECTION B-B

ARMORED FORCE MEDICAL RESEARCH LABORATORY

FEBRUARY 20, 1943 MAJ. F. S. BRACKETT

SCALE - FULL SIZE